Challenges to the clinical application of pluripotent stem cells: towards genomic and functional stability.

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Public Summary:
In this review, we discuss the progress and bottlenecks in the clinic development of human pluripotent stem cells.

Scientific Abstract:
ABSTRACT: Human embryonic stem cells (hESCs) can undergo unlimited self-renewal and are pluripotent, retaining the ability to differentiate into all cell types in the body. As a renewable source of various types of human cells, hESCs hold great therapeutic potential. Although significant advances have been achieved in defining the conditions needed to differentiate hESCs into various types of biologically active cells, many challenges remain in the clinical development of hESC-based cell therapy, such as the immune rejection of allogeneic hESC-derived cells by recipients. Breakthroughs in the generation of induced pluripotent stem cells (iPSCs), which are reprogrammed from somatic cells with defined factors, raise the hope that autologous cells derived from patient-specific iPSCs can be transplanted without immune rejection. However, recent genomic studies have revealed epigenetic and genetic abnormalities associated with induced pluripotency, a risk of teratomas, and immunogenicity of some iPSC derivatives. These findings have raised safety concerns for iPSC-based therapy. Here, we review recent advances in understanding the genomic and functional stability of human pluripotent stem cells, current challenges to their clinical application and the progress that has been made to overcome these challenges.